

**CLAIMS**

1. Porous structure comprising a porous carbon-fibre matrix (3, 15, 27, 37), said porous matrix being  
5 bounded on least one of its faces (5, 17, 21, 30, 40, 42) by an impermeable layer (7, 19, 23, 29, 39, 41) made of a carbon element chosen from carbon fibres, carbon nanotubes, glassy carbon or combinations of these, said impermeable layer being linked to the  
10 porous matrix via carbon-carbon bonds.

2. Porous structure according to Claim 1, in which said porous matrix (3) is bounded on a first face (5) by an impermeable layer (7), as defined in Claim 1, and  
15 on a second face (9) opposite the first face (5) by a porous layer (11) made of a carbon element chosen from carbon fibres and carbon nanotubes, said porous layer being linked via carbon-carbon bonds to the porous matrix.

20 3. Porous structure according to Claim 1, in which said porous matrix (15) is bounded on a first face (17) by an impermeable layer (19) and on a second face (21) opposite the first face (17) by another impermeable  
25 layer (23), said impermeable layers being as defined in Claim 1.

4. Porous structure according to any one of Claims 1 to 3, which further includes a porous layer (31, 33, 43, 45), made of a carbon element chosen from carbon  
30 fibres and carbon nanotubes, on said impermeable layer or layers (29, 39, 41) and/or on one face (32) of the porous matrix (27).

35 5. Porous structure according to Claim 2,

characterized in that it further includes an active layer (12) on said porous layer or layers (11).

6. Bipolar plate or electrode/bipolar plate assembly  
5 comprising a porous structure as defined in any one of Claims 1 to 5.

7. Process for manufacturing a porous structure as defined in any one of Claims 1 to 6, characterized in  
10 that said process includes a step of producing said impermeable layer(s):

1) by the growth of carbon elements, chosen from carbon fibres and carbon nanotubes, on one face or on two opposed faces of a carbon-fibre matrix  
15 followed by densification of said carbon elements; and/or

2) by formation of glassy carbon on one face or on two opposed faces of a carbon-fibre matrix when the carbon element is glassy carbon.

20

8. Manufacturing process according to Claim 7, which includes a step of producing said carbon-fibre matrix by the needle-punching of carbon fibres.